
NSTX RWM Active Feedback Physics Design – Quick Recap

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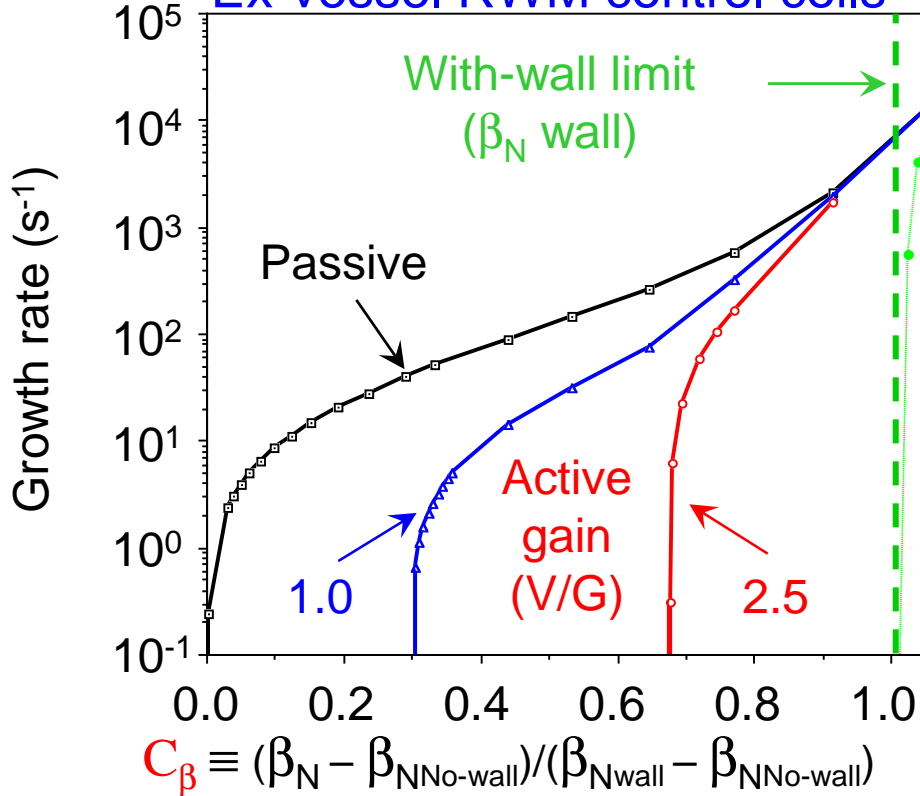
NSTX Global Mode Stabilization Meeting

December 5th, 2003

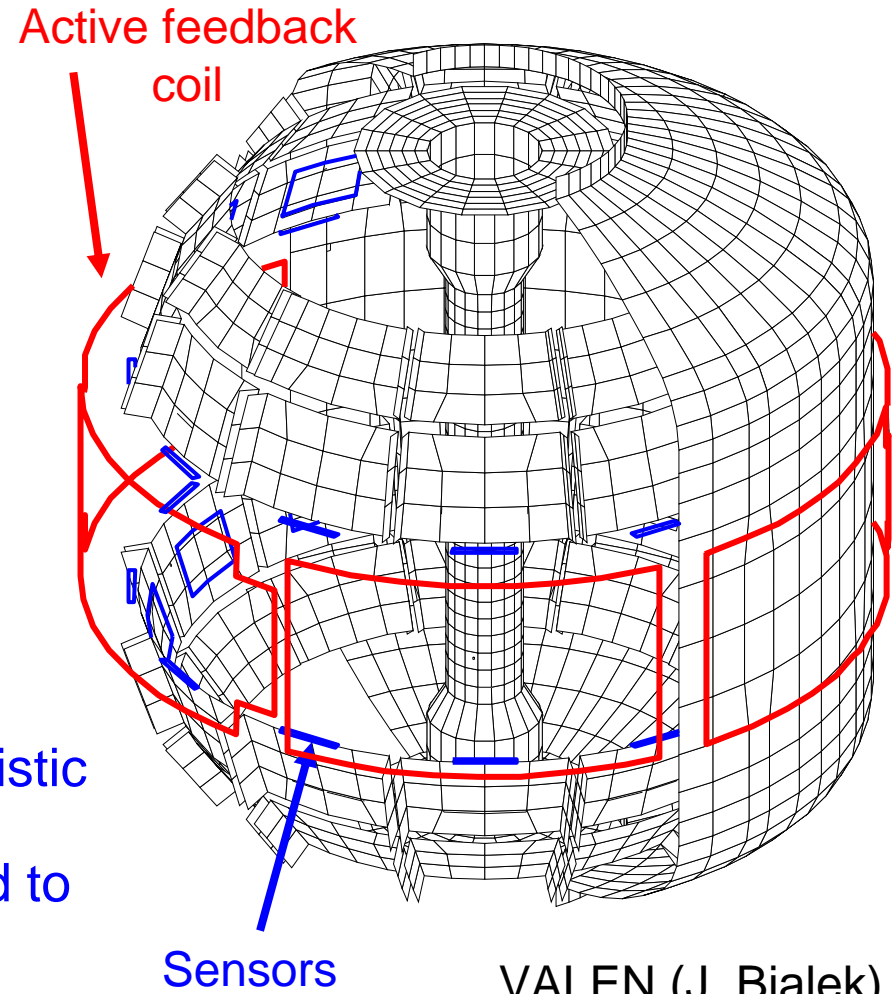
PPPL

Active control may sustain 68% margin above $\beta_{N\text{no-wall}}$

Ex-vessel RWM control coils



VALEN model of NSTX
(cutaway view)



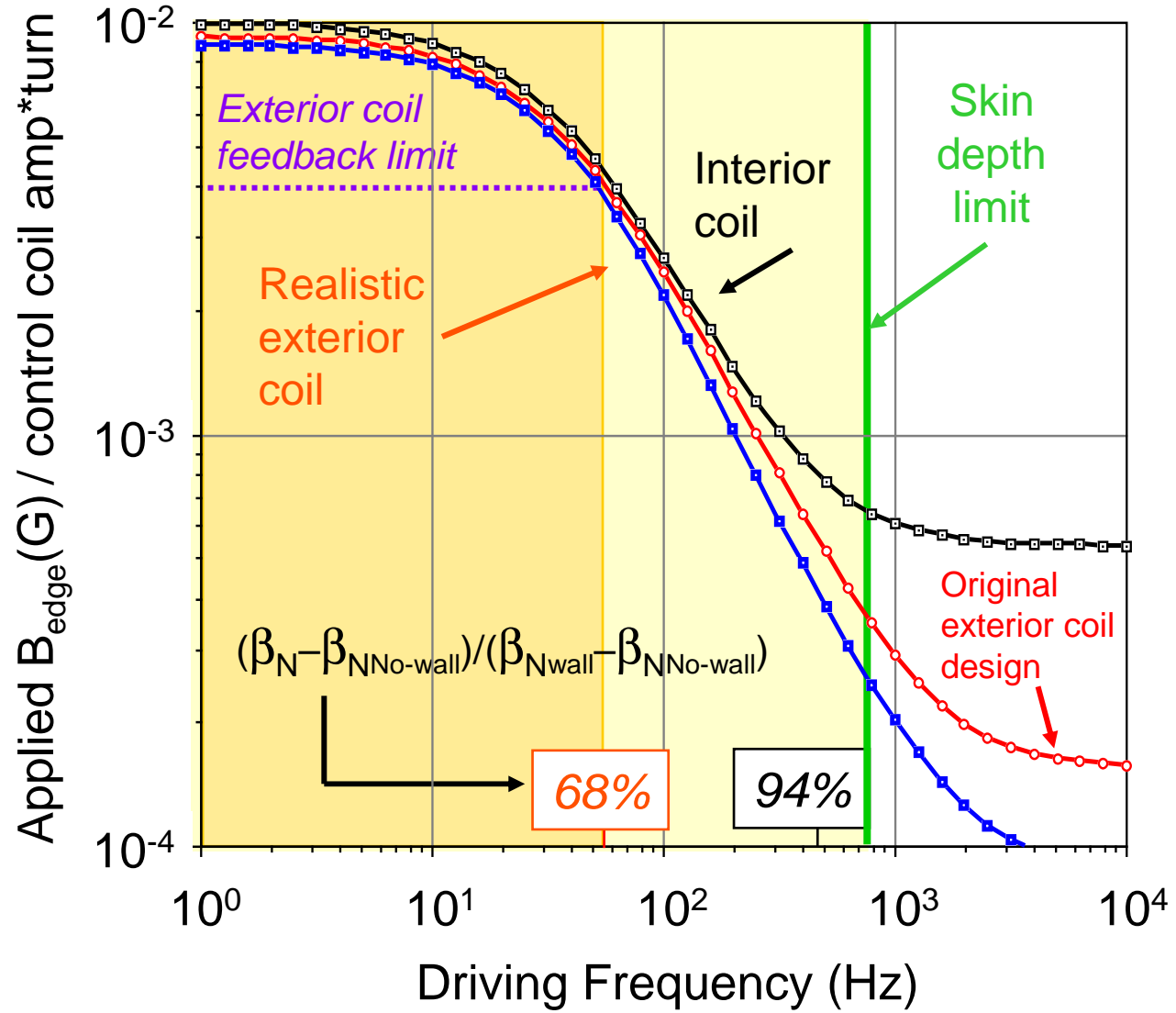
VALEN (J. Bialek)

- External control coil design with realistic geometry
- Internal control coil design computed to reach $\Delta\beta_N = 94\%$

(Equilibria used have $\beta_{N\text{no-wall}} = 5.1$; $\beta_{N\text{wall}} = 6.9$)

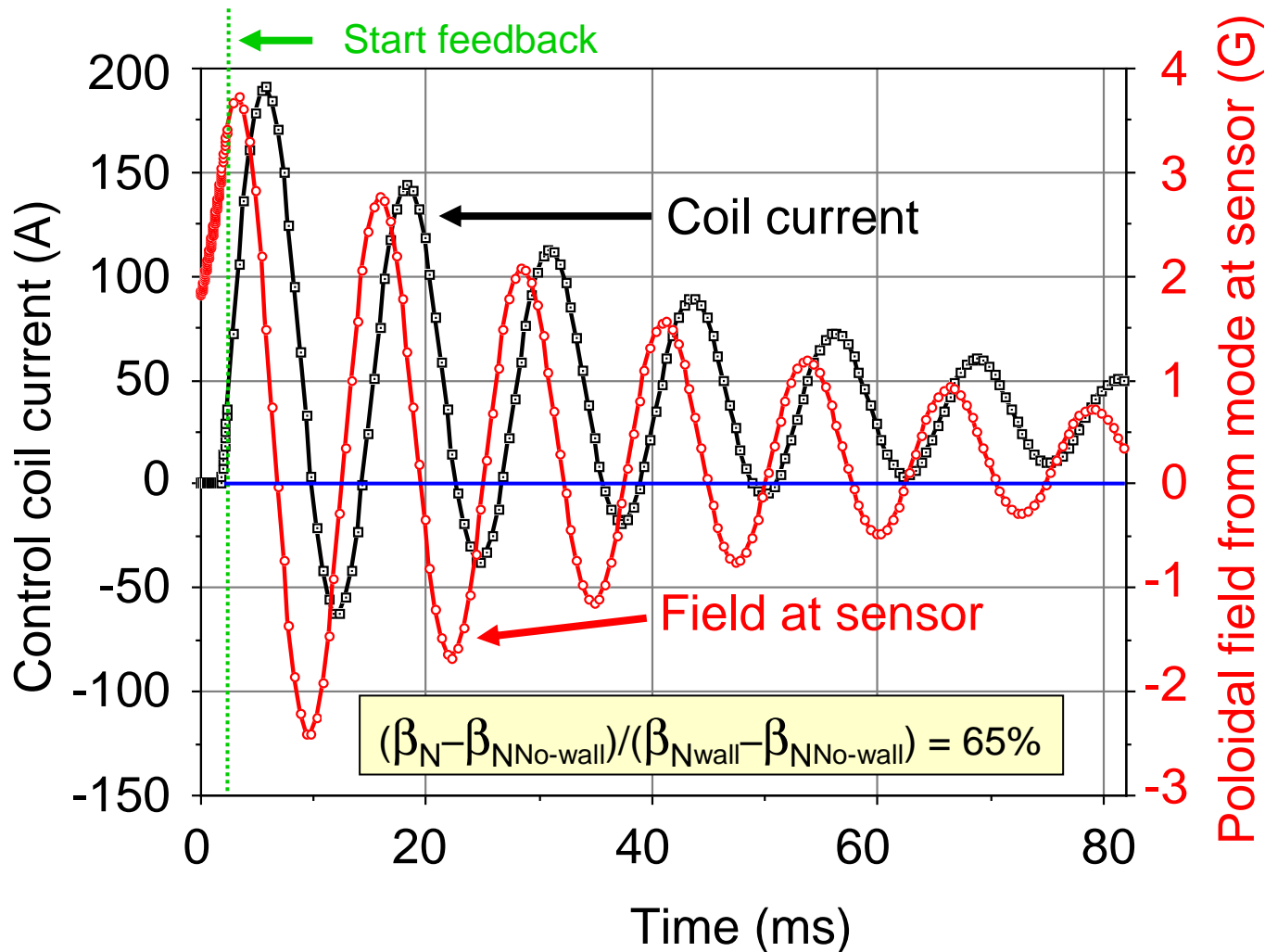


Exterior control coil can provide adequate stabilizing field



- Initial system plan has 6.8kA*turns (Applied $B_{edge} = 27\text{G @ } 54\text{Hz}$)
- Exterior coil design decision based on time, budget, risk constraints balanced by performance

Active mode control modeling shows mode stabilization



- “Mode control” feedback algorithm simulation
- Ideal system response (no latency)
- Simulations including latency show 200 μs is maximum time delay allowing stabilization at highest β_N

The external coil / SPA power supply approach still a viable path forward

- The anticipated time delays are acceptable, but small margin
 - Stabilization at the highest β_N may be marginal (requires $< 200\mu\text{s}$)
- Stabilization potential remains high with realistic coil model
 - Present “Labik” coil model shows possible stabilization at $C_\beta = 68\%$
- System performance with present sensors being evaluated
 - See J. Bialek’s talk (next)
- Consider far less capable solutions only as an extreme fall-back position
 - For example, audio amps / external coil – perhaps better than nothing
 - Audio amps are not a SPA replacement!
 - VALEN calculations underway to evaluate such a system